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Methods of Assessing Western Spruce Budworm Populations and Damage

Assessment of forest pests in Canada and the United States is done principally by the Canadian Forestry Service's Insect and Disease Survey (FIDS) and the U.S. Department of Agriculture, Forest Service (USFS), with some surveys also being undertaken by Provincial, State and private landholders. Pest populations and damage are measured to evaluate current and potential problems. FIDS maintains a series of permanent sampling stations for western spruce budworm and other defoliators in British Columbia and the Yukon where trees are sampled annually for free-feeding larvae by the beating technique. Three trees are beaten at each location with a 3.6 m pole into a 2 x 3 m cloth. This technique, also used by the USFS on a limited basis, provides an estimate of the numbers of larvae per sample and percentage of positive samples (Fig. 1) which are useful in showing trends. Aerial surveys are also conducted each summer over susceptible forests to detect populations in inaccessible stands and to map defoliated areas.

When significant budworm populations are found by beatings and aerial techniques, specific surveys are instituted. Egg mass surveys, conducted in the fall, use the numbers of egg masses per unit area of two mid-crown branches per tree to predict subsequent spring larval populations and defoliation. In Canada, 50-cm branch tips and in the U.S.A., 70-cm branch tips are the

sampling units. Egg mass counts are often made with ultraviolet light, under which the eggs fluoresce and are more visible.

Losses of current foliage and all foliage are ocularly estimated in B.C. at three levels in the crown for 10 trees at a site. The USFS classifies defoliation into one of six categories by examining 25 of the current year's shoots per branch on four mid-crown branches per tree from 3 trees per site.

Surveys of young larvae overwintering on the bole and branches are sometimes done in the winter. Foliage and bole sections are warmed, causing the larvae to emerge over paper ringed with a sticky barrier, or are placed in boxes with openings to the light.

Older larvae are counted by hand-picking or beating them from the foliage, or by dissecting the buds when necessary. Larval counts are related to a standard such as numbers of branches or buds, branch area or weight. The standard used by FIDS is the number of larvae per 10 m² of foliage from two 50-cm mid-crown branches of three trees. In the western U.S., the standard sample is four 40-cm branch tips from the mid-crown, related to the number of buds.

Most sample methods can reach only small trees (10-20 m) and the lower crowns of large trees (25-30 m).



Fig. 1 Western spruce budworm larval populations and defoliation for the Hope-Lillooet-Pemberton, B.C. area, 1949-1978.



Fig. 2. "Bucket" branch sampler tears branches from trees for examination for budworm eggs or larvae. Sampler is under development by B.C. Forest Service, principally for cone collecting.

Preferred samples are usually from mid-crown or higher and in representative stands. Tall tree-top samples have been obtained in B.C. using a line-throwing gun and a branch cutter drawn into tree crowns on the line. To reach tree tops and trees up hillsides where there frequently are no roads, a method was tested in 1977 using a helicopter to tear off foliage by dragging a toothed "bucket" up through the crowns (Fig. 2), and as a platform from which branches were hand-picked directly from the tops of exposed trees. Helicopters can be less expensive per sample than other means when many samples are required, such as during a control program.

Ground surveys have the disadvantage of sampling only a portion of the total area, and are usually limited to areas near roads. Efforts are made to locate permanent sampling stations, in areas most likely to contain early rising populations and damage, by examining an extensive file of historical records.

Aerial surveys are a good way to spot problems. Defoliation is sketch-mapped from light aircraft. The method requires trained observers and considerable aircraft time but is generally adequate, unless more precise maps are needed, in which case hand-held 35- or 70-mm cameras or fixed-mount, 35-mm or larger format cameras are employed.

Large-scale, color pictures are used in the laboratory to refine preliminary sketch-maps. In instances where less detail is required, small-scale photography (approximately 1:70,000 or smaller) may be used, reducing the number of photographs needed. Resource satellite (LANDSAT) data have also been examined and may be useful tools if resolution can be improved. At present, only distinct infestations can be seen and many other discolorations appear as infestations.

John W.E. Harris — Pacific Forest Research Centre, Victoria, B.C.

Lawrence E. Stipe — USDA Forest Service, State and Private Forestry, Missoula, Montana

Canada/U.S. Joint Registration of Insecticides

A meeting was held in Ottawa, Canada during July to explore the feasibility of sharing or exchanging data to expedite registration in the two countries for spruce budworm control. Participants were:

Ross Macdonald, Director, Forest Protection Branch, CFS

Chuck Buckner, Program Leader, CANUSA, CFS

Bob DeBoo, Forest Protection Management Institute, CFS

Errol Caldwell, Pesticides Section, Canada Agriculture

Herb Harrison, Branch Chief, US-EPA

Fred Honing, Assistant Director, FIDM, USDA Forest Service

Bob Lyon, FIDR, USDA Forest Service

Mel McKnight, Program Leader, CANUSA, USDA Forest Service

Objectives for the meeting were to establish lines of communication for sharing data, to discuss registration requirements in each country, and to determine ways to minimize duplication of work and speed the joint registration process.

As a result of this meeting, a formal procedure will be outlined for sharing data between the two countries and developing joint registrations. A "pilot test" joint registration will be undertaken as soon as possible, using the procedures developed by this task force.

Polo

The development of Polo, a new computer program for analyzing laboratory insecticide bioassay data, has recently been published (Russell, R.M., J.L. Robertson and N.E. Savin, E.S.A. Bulletin, 23 (3): 209-13). This program allows either probit or logit analysis and is designed for simplicity, flexibility and to minimize user error. Polo is currently operational on the Univac 1108 series of computers. A copy of the program and instructions may be obtained by sending a magnetic tape with format instructions to: Director, Pacific Southwest Forest and Range Experiment Station, Box 245, Berkeley, Ca., 94701, Attn: Computer Service Librarian.

CANUSA Working Groups

The second annual CANUSA (East) working group meetings will be held at the Sutton Place Hotel, Toronto, Canada, during the week October 29-November 2, 1979. CANUSA (West) are holding their meetings one week earlier, October 22-26, at the Imperial Inn, Portland Oregon. Objectives for these meetings will be to discuss budworms research needed to attain CANUSA goals and projected accomplishments, and to review progress of on-going CANUSA research.

Summer Activities

Members of CANUSA (East) Program Management have been visiting funded investigators during the past 3 months, to discuss their research progress. We have been impressed with both the progress being made and the enthusiasm shown by individual researchers. Requests for new research proposals, to be funded in FY 1980, will be mailed to interested scientists directly after the working group meetings in Toronto.

Demonstration Areas

Several CANUSA-sponsored Demonstration Area projects have been organized this summer. Administration for these projects has been assigned to Northeastern Area, Forest Insect and Disease Management. The current status of one of them was discussed by Gord Mott, USDA Forest Service, at the 1979 Central International Forest Insect and Disease Conference at Merrimac, Wisconsin, on October 2, 1979. The project is entitled "The Integration of Targeted Harvesting of Balsam Fir with Precision Chemical Protection" and was submitted jointly with Dr. John Dimond, University of Maine. Gordie plans to give us a feature article for one of the upcoming Newsletters.

To Spray Or Not To Spray?

A legislative committee returned from Cape Breton recently with a clear and disturbing picture of what happens to a budworm infested forest that isn't sprayed, according to committee chairman David Bishop (PC-York North). "I think we all came to the conclusion indi-

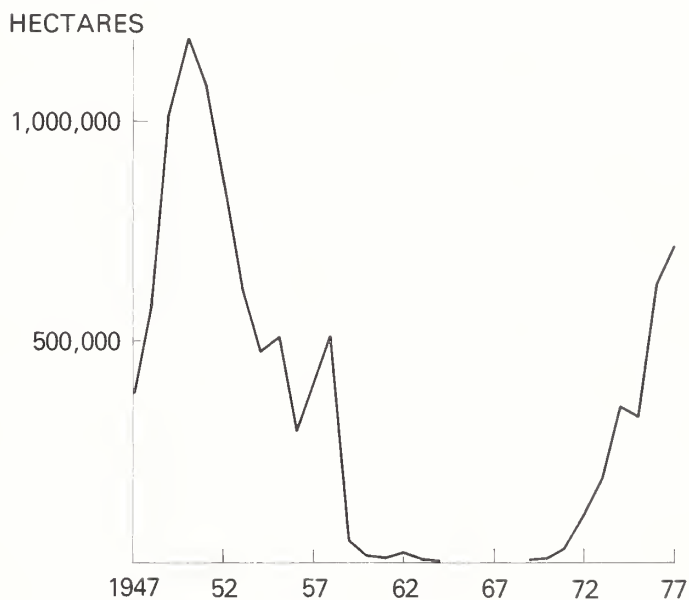
Omission — Newsletter No. 6

Please insert this page in your copy of Newsletter No. 6. We regret these illustrations were omitted from the printing of that Newsletter.

Fig. 1 Probable distribution of populations of four western species of *Choristoneura*.



Fig. 2 Annual area within Washington, Oregon and British Columbia of noticeable defoliation caused by *C. occidentalis*.



vidually that we don't dare stop spraying in New Brunswick until we find a better and more efficient way of controlling the budworm", he said.

In Cape Breton, the legislature's select committee on renewable resources, saw 350,000 acres of dead, gray trees. "The softwood was all gone," Mr. Bishop said. "The anxieties you go through with the loss of a forest would be just unbelievable. You have to be there to see how depressing it is."

(Halifax Chronicle Herald, July 10, 1979)

Publications Available

George Harvey and P. Roden have published Report O-X-293, "Collections of *Choristoneura* species and hybrids". Copies available from Great Lakes Forest Research Centre, Box 490, Sault Ste. Marie, Ontario, P6A 5M7. John Harris and company also have an interesting Report BC-X-182 dealing with Landsat Data for damage appraisal. For copies write Pacific Forest Research Centre, 506 West Burnside Road, Victoria, B.C., V8Z 1M5. And from the same establishment A.J. Thomson's Report BC-X-186, "Relationships of Budworm and its Hosts" is well worth reading.

The "International Directory of Federal, State, and Provincial Personnel Responsible for Research, Development, and Implementation of Pest Management Programs for the Spruce Budworms in the United States and Canada" was sent to everyone on the mailing list for the CANUSA Newsletter. If you or your colleagues need additional copies, please contact Mel McKnight in Washington or Chuck Buckner in Ottawa.

Address Change

The correct address for the CANUSA-West office is 809 N.E. 6th Avenue, Portland, Oregon, 97232. The proper address for Dr. W.J. Carroll, Director of the Newfoundland Forest Research Centre is: Building 304, Pleasantville, P.O. Box 6028, St. John's, Newfoundland, A1C 5X8, (Telephone: 709 - 737-4683).

International Inventory

Issue No. 2 of the CANUSA R&D Management Inventory has been distributed to investigators who provided information on their activities, and to Program Management offices in Canada and the United States. This issue contains 250 studies or projects (up from 188 in Issue No. 1 for 1978) representing the work of 240 investigators (up from 204). Each investigator is provided an index which lists the studies being conducted under each activity in the CANUSA Program Activity Schedule, and the names, addresses, and phone numbers of all investigators. Full information on any specific study of interest is available from Program Leaders Buckner or McKnight.

Spruce Budworms Literature Data Base

Under the watchful eyes of Fred Knight (University of Maine - Orono) and Dan Jennings (USDA-FS, Northeastern Station - Orono), the computer-based file of literature citations on spruce budworms is growing by "leaps and bounds." Sue Hacker at UMO is rapidly catching up with the literature which has appeared in the last year and that which has been brought to our

attention since the "Spruce Budworms Bibliography" was published. The new files will eventually be published as a supplement to the Bibliography. In the meantime, we plan to distribute copies to Program investigators as rapidly as they become available.

CANUSA Program Activity Schedule: The Master Plan

Those who attended the western and eastern planning workshops at Portland and Montreal (see Newsletter No. 1) will remember the Convergence Analysis — some called it the "Denver Plan" — that was the springboard for planning the CANUSA Program. Since then, the working groups and Program Management have revised the plan. The new version — the Activity Schedule — was recently approved by the Joint Policy and Program Council.

Call it what you wish — a "blue print," a "road map," a "master plan" — the CANUSA Program Activity Schedule serves several useful functions. With it in hand every investigator can see how his or her work fits into the "Big Picture" and relates to achievement of Program objectives. Program Management finds it useful for soliciting proposals for studies and for making program adjustments. Furthermore, the Activity Schedule displays "who is doing what," progress toward stated goals, and projected work in each Program component for the remainder of the Program.

The CANUSA Program Activity Schedule has a specific purpose — display of the total CANUSA Program. As such, it closely, but not exactly, reflects the programs of each of the Program components: Eastern Canada (ECAN), Eastern United States (EUS), WESTERN Canada (WCAN), and Western United States (WUS). Each component may have much more specific and detailed working plans which may look quite different from the Activity Schedule.

In a nutshell, the Activity Schedule provides the framework for coordination of all R&D on spruce budworms related to Program objectives and identifies opportunities for cooperation between all Program investigators and components. The Activity Schedule is a dynamic document. It will be reviewed and revised annually by Program Management as part of the annual planning and budgeting process. Copies are available from your Program Leader.

Joint Policy and Program Council

The JPPC met in Bangor, Maine on August 30-31. Principal items of business were approval of the CANUSA Program Activity Schedule as the master plan for coordination and cooperation, and approval of plans and budgets for 1980. The JPPC expects the Program to maintain a strong effort on forest management approaches to dealing with the spruce budworms and to increase efforts to develop better tools for projecting socioeconomic impacts of budworm outbreaks. Presentations by CANUSA Program investigators — Mark Houseweart, UMO Cooperative Forestry Research unit; Dan Jennings, NE Station; Gordon Mott, NE Station; and John Dimond, UMO Department of Entomology — were of special interest.

Mr. Einar L. Roget, Deputy Chief for State and Private Forestry, USDA-FS, is a new member of the JPPC succeeding Mr. Philip L. Thornton. His areas of responsibility in the Forest Service include forest insect and disease management on Federal lands and cooperative programs on State and Private lands.

Joint Planning Unit

The JPU met in Baddeck, Nova Scotia, on August 1-2. The major task was an in-depth review of the revised CANUSA Activity Schedule. For the first time since the program began a complete and comprehensive document is available describing the international program, its aims, objectives and component responsibilities. An added column "projected accomplishments" tells us what resource managers might expect at the termination of the agreement. Kingsley Brown, a freelance documentary film-maker showed his recent production "Budworm Politics", and the Province of Nova Scotia arranged for an aerial view of the tree mortality on the Cape Breton highlands. Gerard Paquet, Executive Secretary of the Eastern Spruce Budworm Council replaced Frank Webb who has retired from that post.

Photos

Eastern Program Management secured the services of Roger Zerillo, Hamden Laboratory, USFS, to make a complete set of biological and operational photographs relating to eastern spruce budworm. Roger is a prize winning color photographer specializing in forest insects. Program Management has not given up on developing a photo exchange service during the life of the program, but it requires high quality color photographs for information and education purposes in the near future.

Passing Notes

Chris Shoemaker (Cornell) reports that International Institute for Applied Systems Analysis (IIASA) intends to sponsor a conference in Europe this fall on pest management modelling. Budworm models will be featured. Bill Matson and Nancy Lorimer (North Central Forest Experiment Station) had good field seasons. Some interesting preliminary data analysis were discussed with the Eastern U.S. Program Manager. Steve Sinclair (University of Minnesota) and his group also had minimum start-up problems. He noted that there are at least 5 waferboard projects in varying stages of planning and construction in the Lake States. Aspen is the principal raw material, but balsam fir may be an excellent alternative. Steve's group will be looking at potential technical problems with balsam fir for this use.

Is This Your First CANUSA Newsletter?

Our mailing list for the CANUSA Newsletter is expanding rapidly. If this issue, No. 7, is the first you have received and you like to have any of the earlier issues, please contact Chuck Buckner in Ottawa or Mel McKnight in Washington, D.C.